We claim:

1. A coated metal reinforcement element for a polymeric or elastomeric material comprising: a metal reinforcement element having a metal surface, and a coating for the reinforcement element comprising a polymer deposited from an aqueous solution and compatible with and co-polymerizable with said material to be reinforced, and bearing functional groups covalently bonded to the metal surface of said reinforcement element.

2. A coated metal reinforcement according to claim 1, wherein said polymer is deposited from an alcoholic solution.

3. A coated metal reinforcement according to claim 1, wherein said polymer is deposited from an organic solution.

4. A coated metal reinforcement according to claim 1, wherein said polymer is co-vulcanizable with said polymeric or elastomeric material to be reinforced.

5. A coated metal reinforcement according to claim 1, wherein said polymer is crosslinkable with said polymeric or elastomeric material to be reinforced.

6. A coated metal reinforcement according to claim 1, wherein said functional groups form covalent bonds with the outward directed first functional groups of a mono-molecular layer of a bifunctional adhesion promoter intercalated between said metal and said coating and bound to said metal by its second functional groups.

7. A coated metal reinforcement according to claim 1, wherein said functional groups form covalent bonds with the outward directed first functional groups of a multi-molecular layer of a bifunctional adhesion promoter intercalated between said metal and said coating and bound to said metal by its second functional groups.

8. A coated metal reinforcement element according to claim 1, wherein said coated metal reinforcement element is an elongated steel element.

9. A coated metal reinforcement element according to claim 8, wherein said elongated steel element is coated with one or more metallic layers, comprised of an alloy selected from the group consisting of brass, bronze, zinc, zinc alloy, tin or tin alloy.

10. A coated metal reinforcement element according to claim 9, wherein said zinc alloy is an alloy selected from the group consisting of a zinc-aluminium alloy, a zinc-aluminium-mischmetal alloy, a zinc-manganese alloy, a zinc-cobalt alloy, a zinc-nickel alloy, a zinc-iron alloy or a zinc-tin alloy.

11. A coated metal reinforcement element according to claim 1, wherein said coating comprises a prepolymer deposited from an aqueous solution and compatible with and co-polymerizable with said polymeric or elastomeric material to be reinforced, and bearing functional groups covalently bonding to the metal surface of said reinforcement element.

12. A coated metal reinforcement element according to claim 1, wherein the polymer of the coating comprises a polymer matrix selected from the group consisting of thermoplastics, thermoplastic elastomers, thermoplastic polyolefins, olefinic rubbers, polyurethanes or blends thereof, elastomeric polymers or copolymer or an at least partially elastomeric block copolymer.

13. A coated metal reinforcement element according to claim 11, wherein the prepolymer of the coating comprises a polymer matrix selected from the group consisting of thermoplastics, thermoplastic elastomers, thermoplastic polyolefins, olefinic rubbers, polyurethanes or blends thereof, elastomeric polymers or copolymer or an at least partially elastomeric block copolymer.

14. A coated metal reinforcement element according to claim 11, wherein the prepolymer of the coating comprises a polymer backbone selected from the group consisting of thermoplastics, thermoplastic elastomers, thermoplastic polyolefins, olefinic rubbers, polyurethanes or blends thereof, elastomeric polymers, elastomeric copolymers or an at least partially elastomeric block copolymer.

15. A coated metal reinforcement element according to claim 14, wherein the elastomeric block copolymer is selected from the group consisting of styrene butadiene rubber, butyl rubber, acrylonitrile-butadiene rubber, ethylene propylene dien copolymer, ethylene propylene copolymer, natural rubber, synthetic poly(isoprene) and chloroprene rubber, or a functionalized non-cured rubber composition.

16. A coated metal reinforcement element according to claim 15, wherein the non-cured rubber composition is selected from the group consisting of a synthetic or natural poly(isoprene) or poly (butadiene) and includes common vulcanization additives and curing materials.

17. A coated metal reinforcement element according to claim 1, wherein the functionalities of the functionalized polymer include thiol groups, mercapto groups, silanes, amines, -SH; $-SiHCl_2$; $-SiH_2Cl$; $-Si(Cl)_3$; $-SiHBr_2$; $-SiH_2Br$; $-SiBr_3$; $-Si(R'(Cl)_2)$; $-Si(OR')_3$; $-Si(R'(OR')_2)$; -COOH; -COCl, $-PO_3H_2$, $-SO_2H$, their acid anhydride and their acid chloride groups, organometallic groups of the formula $-M(OR')_n$ or $-M(Cl)_n$, whereby M is a metal selected from the group comprising Al, Sn, B, Ti and V, n being the ligand number corresponding to the metal M, phthalocyanin or phthalonitril groups, monothiol or monothiolate groups, wherein R' is alkyl, namely methyl, ethyl or propyl (branched or unbranched) in case of a bonding directly to the metal surface and include thiol groups, mercapto groups, silanes, amines, -SH; $-SiHCl_2$; $-SiH_2Cl$; $-Si(Cl)_3$; $-SiHBr_2$; $-SiH_2Br$; $-SiBr_3$; $-Si(R'(Cl)_2)$; $-Si(OR')_3$; $-Si(R'(OR')_2)$; -COOH; -COCl, $-PO_3H_2$, $-SO_2H$, their acid anhydride and their acid chloride groups, phthalocyanin or phthalonitril groups, monothiol or monothiolate groups; all these groups either as terminal groups or carried along the polymer backbone or as part of side chains, as well as epoxy groups carried along the polymer backbone.

18. A coated metal reinforcement element according to claim 1, wherein the adhesion promoter is a bifunctional compound of the general formula (I)

$$X\text{-}(R)_n\text{-}(Ar)_l\text{-}(R)_mY \qquad (I)$$

with x representing a group capable of reacting covalently at the metal surface,

R representing an organic spacer chain,

Ar representing an aromatic and/or heteroaromatic system,

Y representing a group capable of forming covalent bonds to the functional groups of the polymer or prepolymer of the coating, and

$0 \leq n,m \leq 16$; $0 \leq l \leq 6$.

19. A coated metal reinforcement element according to claim 17, wherein the groups of formula (I) are as follows:

X: -SH; $-SiHCl_2$; $-SiH_2Cl$; $-Si(Cl)_3$; $-SiHBr_2$; $-SiH_2Br$; $-SiBr_3$; $-Si(R'(Cl)_2)$; $-Si(OR')_3$; $-Si(R'(OR')_2)$; -COOH; -COCl, $-PO_3H_2$, $-SO_2H$, their acid anhydride and their acid chloride groups

an organometallic group of the formula $-M(OR')_n$ or whereby M is a metal selected from the group comprising Al, Sn, B, Ti and V, n being the ligand number corresponding to the metal M;

a phthalocyanin or a phthalonitril group;

a monothiol or a monothiolate group;

with R' being alkyl, namely methyl, ethyl or propyl (branched or unbranched),

Y: NH_2, NHR', or NR'_2, or an unsaturated residue, especially an unsaturated terminal double or triple carbon-carbon bond; an acrylic or methycrylic acid group and ist methyl or ethyl esters;

-CN; an activated carboxylic ester; an aldehyde group; an epoxide group;

-SH; $-SiHCl_2$; $-SiH_2Cl$; $-Si(Cl)_3$; $-SiHBr_2$; $-SiH_2Br$; $-SiBr_3$; $-Si(R'(Cl)_2)$; $-Si(OR')_3$; $-Si(R'(OR')_2)$; -COOH; -COCl; or a functional group capable of forming a complex with at least one ingredient of the non-metallic medium.

R: $-CH_2-$; a $-(CH_2)$-chain, whereby $2 \leq n \leq 20$ and whereby said chain may be unhalogenated, partially halogenated or perhalogenated and may contain aromatic or thiophen units, and whereby the chain and/or the units may comprise substituents selected from the group comprising:

$-(CH_2)_iCH_3$ with $0 \leq i \leq 5$, $-O(CH_2)_jCH_3$, or $-O(CF_2)_jCH_3$ with $0 \leq j \leq 4$, -CN and $-NH_2$; $-CF_2-$; $-CH_2-CO-NH-CH_2-$; $-CF_2-CO-NH-CF_2-$; $-CH_2-CO-NH-CF_2-$; $CF_2-CO-NH-CH_2-$ and $0 \leq n,m \leq 16$,

AR: an aromatic and/or heteroaromatic system, optionally substituted, for example according to the above cited list of substituents.

20. A coated metal reinforcement element according to claim 1, including an additional layer of the polymeric or non-cured elastomeric composition on top of said coating for further reinforcement.

21. A coated metal reinforcement element according to claim 20, wherein the non-cured elastomeric composition of the additional layer is a vulcanizable rubber composition.

22. A method for coating a metal surface with an adhesion promoter, comprising the steps of

selecting an adhesion promoter which is an organosiloxan of the general formula (I)

$$X\text{-}(R)_n\text{-}(Ar)_1\text{-}(R)_m\text{-}Y$$

wherein X is a siloxane group, a chlorosilane group or a bromosilane group selected from the group consisting of -SH; $-SiHCl_2$; $-SiH_2Cl$; $-Si(Cl)_3$; $-SiHBr_2$; $-SiH_2Br$; $-SiBr_3$; $-Si(R'(Cl)_2)$; $-Si(OR')_3$; $-Si(R'(OR')_2)$; -COOH; -COCl;

pretreating X before use by adding a definite amount of water under stirring at an elevated temperature, the amount being calculated to at least partially hydrolyze and to partially condense the siloxan;

preparing a solution of the adhesion promoter and diluting the solution with alcohol; and

immediately after a certain ripening period applying the diluted solution to said metal surface, thereby forming a dense mono- or multimolecular layer on the metal surface.

23. A method according to claim 22, wherein the hydrolysis is catalyzed by hydrolyzed 3-amino-propyl-trimethoxysilane.

24. A method according to claim 22, wherein the hydrolysis is catalyzed by partially hydrolyzed 3-amino-propyl-trimethoxysilane.

25. A method according to claim 22, wherein the metal is selected from the group consisting of zinc or zinc alloy, tin or tin alloy, brass, bronze.

26. A method according to claim 22, wherein the metal is steel coated with one of the metals selected from the group consisting of zinc or zinc alloy, tin or tin alloy, brass, bronze.

27. A method according to claim 22, including pretreating the metal surface with iPrOH, iPrOH-H_20, Hcl_{aq}, carbonate, KOH, separately or in any combination.

28. A method for coating a metal surface, comprising the steps of:

depositing an adhesion promotor from an aqueous, alcoholic or organic solvent, and

depositing a functionalized non-cured polymer or prepolymer from an aqueous, alcoholic, or organic solvent, or from the bulk material.

29. A method according to claim 28, wherein said depositing is carried out in a one step procedure.

30. The method according to claim 28, wherein the metal is selected from the group consisting of zinc or zinc alloy, tin or tin alloy, brass, or bronze.

31. The method according to claim 30, wherein the metal is steel coated with one of the metals selected from the group consisting of zinc or zinc alloy, tin or tin alloy, brass, or bronze.

32. The method according to claim 28, including the step of pretreating the metal with iPrOH, iPrOH-H_20, Hcl_{aq}, carbonate, KOH, separately or in any combination.